

GE9X Inner & Outer Combustor Liner Scrub Station

GE Aerospace



Western Carolina UNIVERSITY

PROBLEM STATEMENT

- Currently, parts must be manually cleaned of all debris and residue before inspection after the machining process.
- Operators must hand-wipe and deburr all features of the part; this is a very labor-intensive process.
- Missed debris causes invalid inspection results and an 8-hour reprocessing of the part.

The GE plant is constantly increasing production rates, and a safer, faster, and more ergonomic method of cleaning the part is needed. Since the current process is manual and flawed, a semi-automated method is necessary.

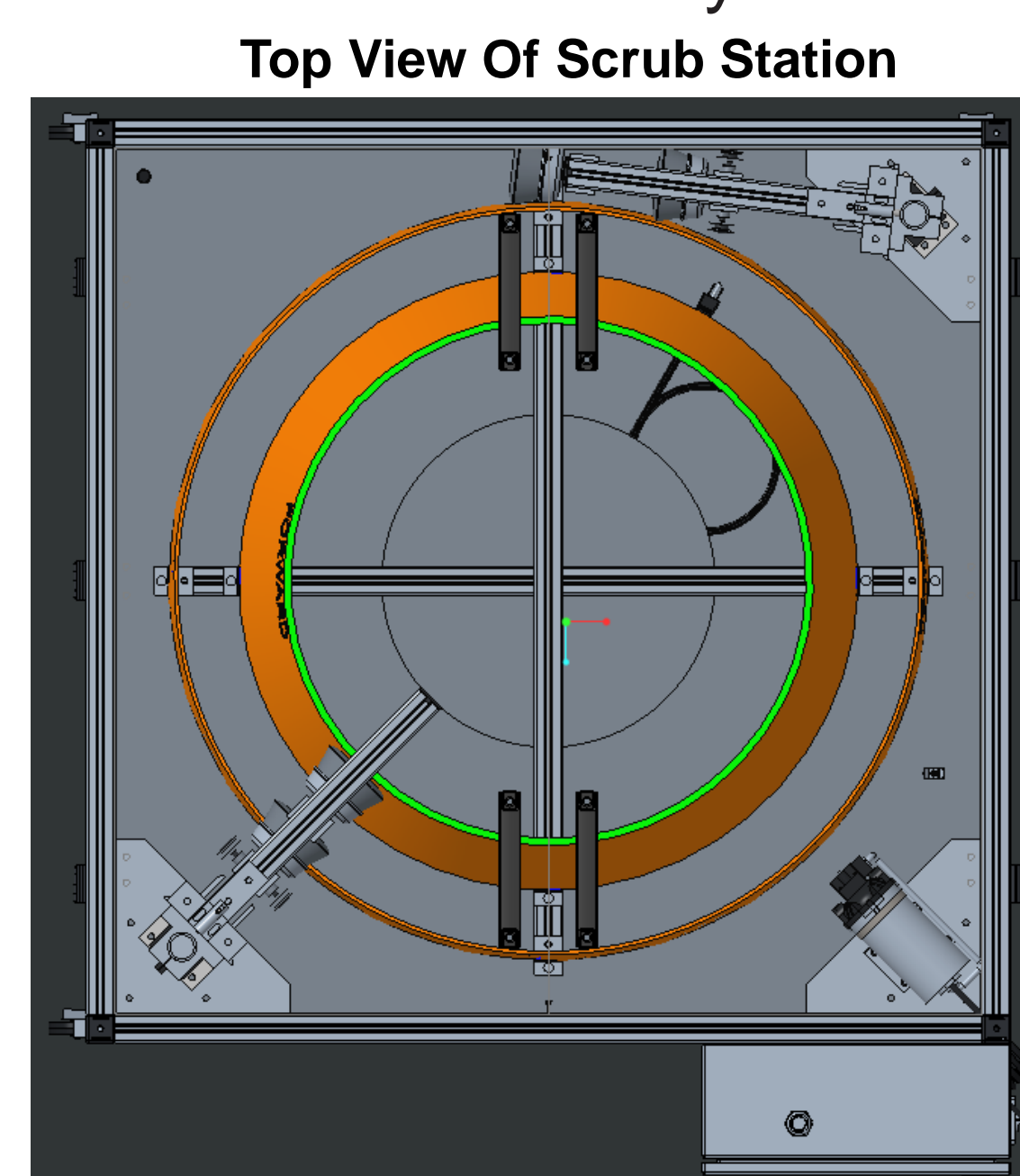
REQUIREMENTS

- Along with the requirements below, the budget GE provided was \$3,000. After purchasing various crucial components, the project totaled \$5,714 but still warranted approval from GE.

#	Description
1	Ability to clamp the inner and outer combustor liners.
2	Operation/ functionality of the equipment must not pose risk of damage to the part/ person.
3	Minimal equipment footprint for shop floor layout.
4	Cycle time of 15 minutes or less.

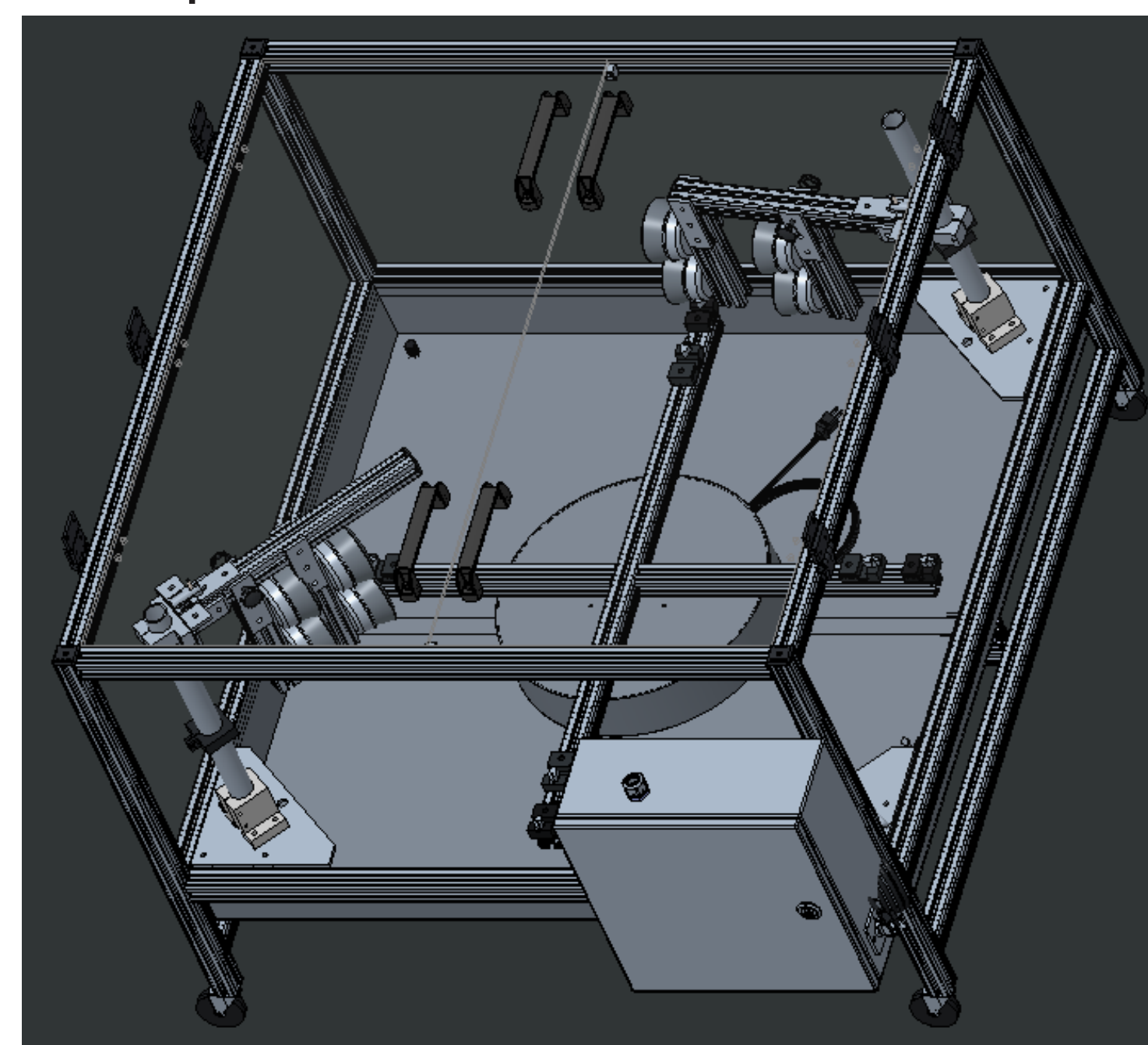
CONCEPTS

- The original approach was to keep the part stationary while the brushes rotated. However, the final concept is that the parts will rotate as the brushes remain stationary.



FINAL DESIGN, APPROACH, PLAN

- The combustor liners will sit in clamps and rotate as flat circular brushes scrub away debris and residue. The scrub station will be controlled by an electrical box to ensure everything works properly. An emergency stop and magnetic door interlocks will be utilized for added safety of the parts and operators.

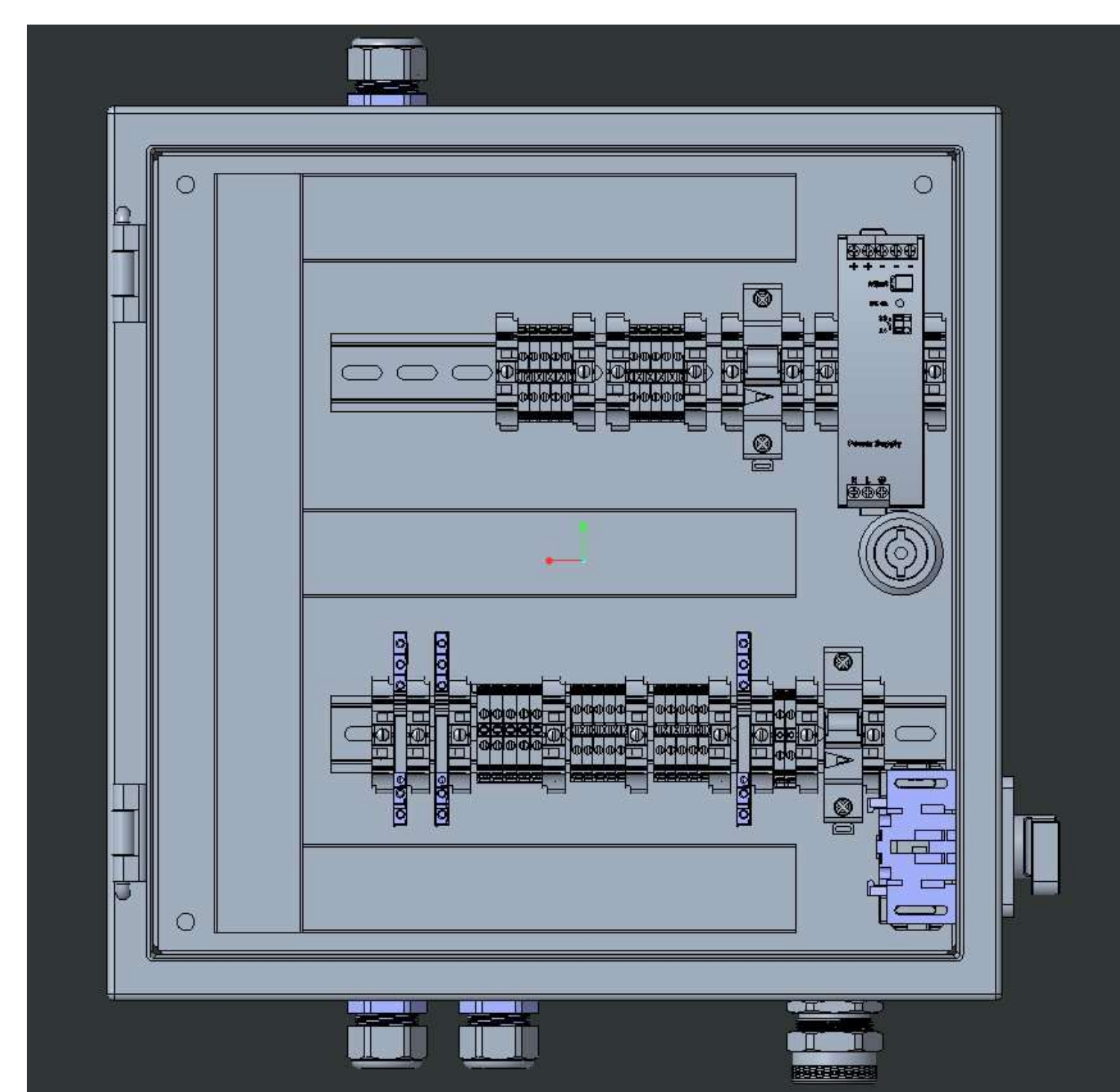


Scrub Station Frame

Brush Arms



Electrical Box



RESULTS

Risks were determined for each initial design before selecting the final design. The testing process was conducted throughout the assembly. These tests included the water system, electrical system, turntable, and brush arms.

Risk Matrices

Criteria	Weighting	Design 1 Cylindrical Tank	Design 2 CNC Scrubber	Design 3 Double Brush	Design 4 Flux & Air Compression
Manufacturability	3	2	3	3	3
Health	1	3	3	5	4
Feasibility/Complexity	5	2	3	3	3
Cleanliness	5	3	2	4	4
Risk of Component Replacement	3	3	3	3	2
Safety	5	4	5	4	4
Cost	4	2	2	3	1
Ergonomics	4	3	4	5	4
Machine Footprint	4	1	4	4	4
Total		87	111	126	110

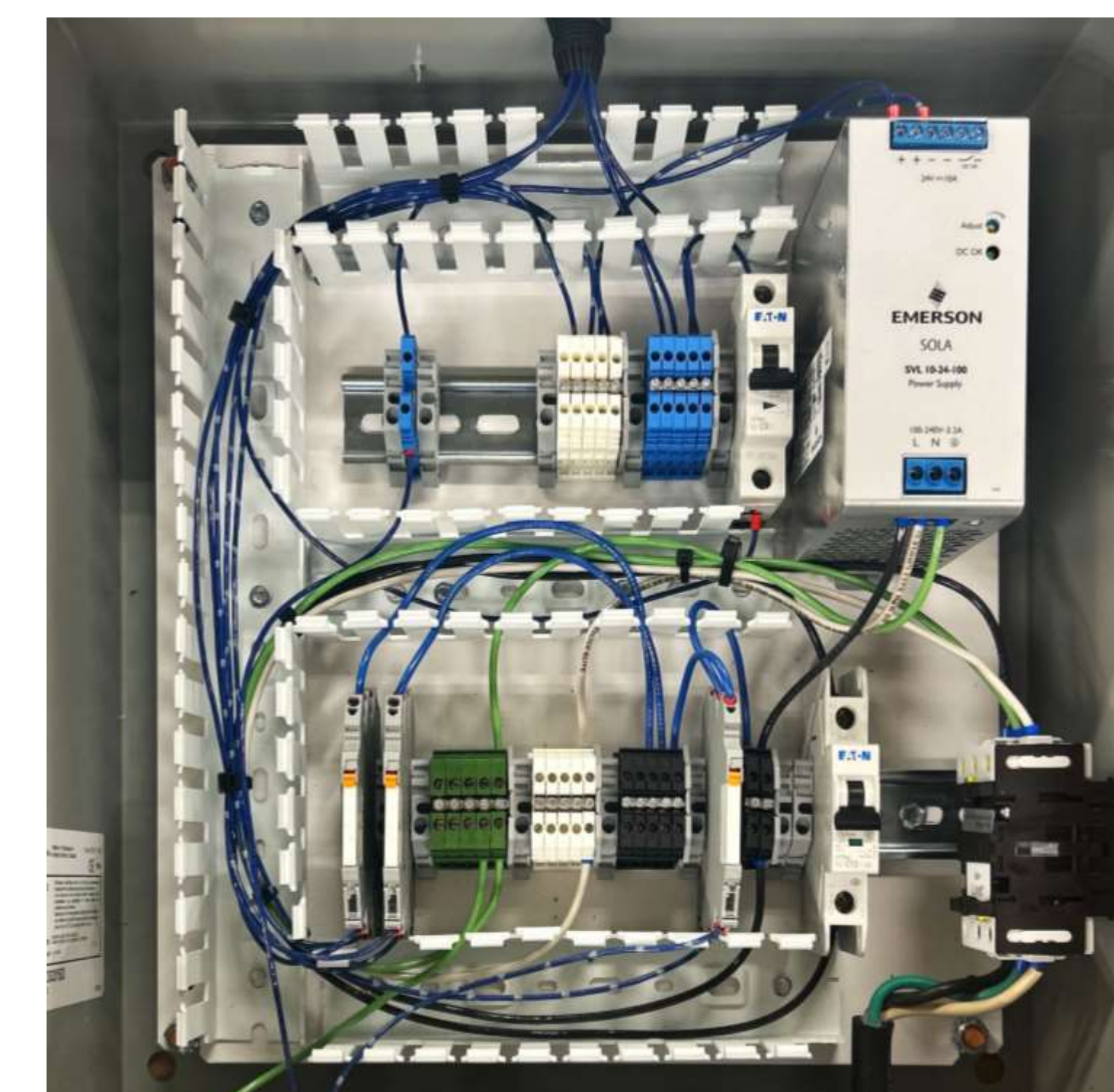
Weighting Key	
1 (least important)	5 (most important)

Design Key	
1 (low performance)	5 (high performance)

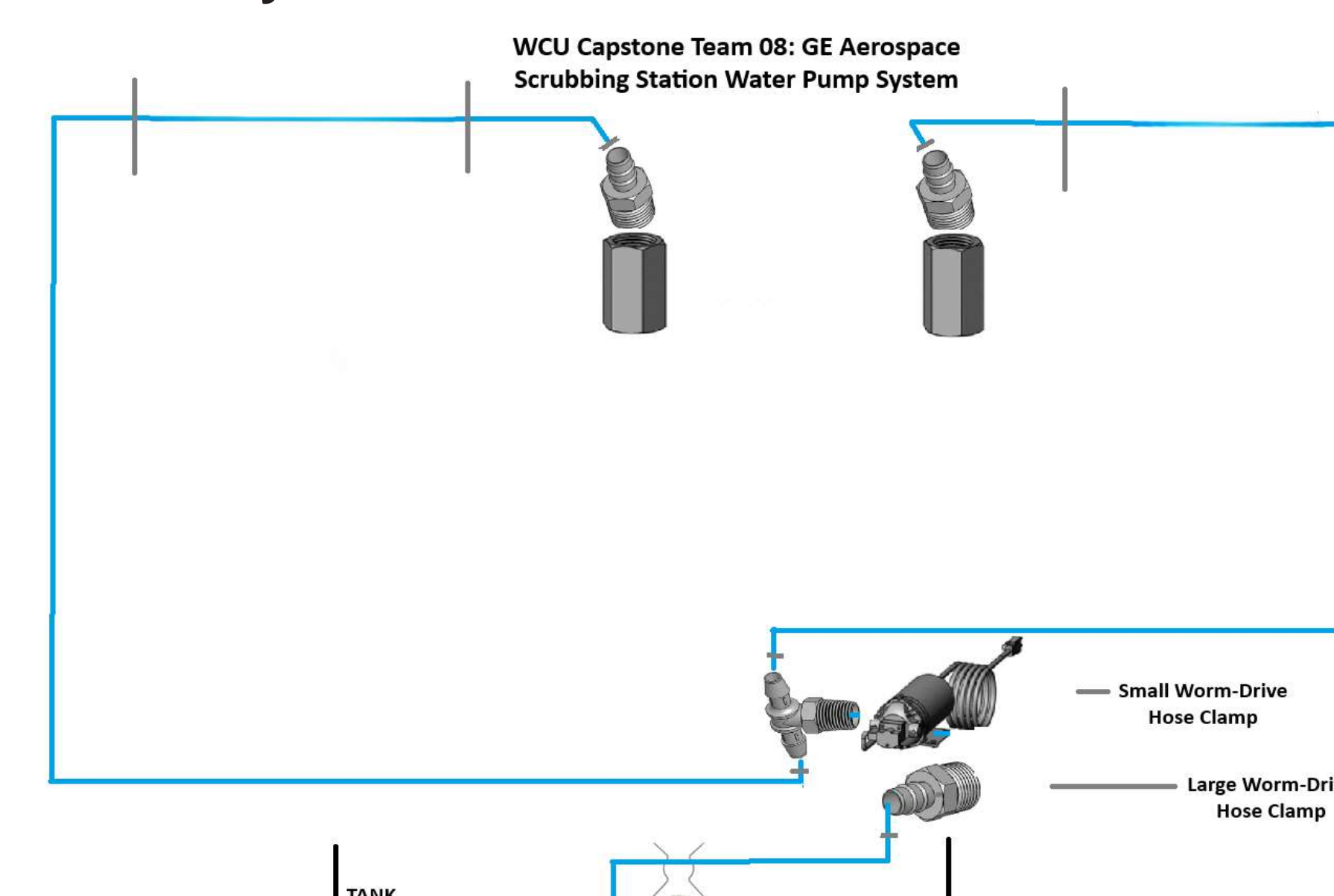
* The design with the largest score is the most optimal *

Problem	Probability	Impact	Risk Level	Action
Frame Fittings	L	M	Moderate	Reconstructing frame fittings
Motor Issue	L	H	Major	Contacting the manufacturer
Water Pump Issue	L	H	Major	Contacting the manufacturer
Electrical Connections	L	H	Major	Reordering components
Budget	M	H	Major	Repurposing the design

Electrical Box



Water System



SUMMARY AND CONCLUSIONS

A combustor liner scrub station was designed and manufactured to meet all requirements established by GE Aerospace. The scrub station will minimize the time taken to clean and deburr the combustor liners while passing CMM and IR inspections more frequently. The addition of extra safety features provides an additional facet of safety to the operators and combustor liners.



FUTURE WORK

The scrub station will be implemented on the GE Aerospace shop floor and used to ensure the combustion liners are properly cleaned and can pass inspection, with little to no failures.

TEAM & ACKNOWLEDGEMENTS

- Capstone Team: Mya Carter (EPE), Madison Cox (EE), Alexander Collins (ET), & Zach Williams (ME).
- GE Aerospace: Triston Jones, Bradly Lams, Will O'Shields, Riley Seyffert & Brad Shipman
- Instructors/Mentors: Prof. Brett Banther, Shawn Lyvers & Dr. Andrew Ritenour.

